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SPECIAL REPORT -- SCIENCE AND ENGINEERING EMPLOYMENT OPPORTUNITIES

SCIENCE TRENDS departs from its normal pattern of coverage this week to bring you a timely Special Report prepared by the U.S. Department of Labor on employment opportunities and trends in engineering and the sciences. As can be expected, specialists in fields connected with the defense effort are in most demand.

Engineering

This spring about 39,500 students will receive bachelor's degrees in engineering, the largest professional field of employment for men. The job outlook for these engineering graduates is, on the whole, very good and for graduates in some specialties, excellent. Engineering graduates with strong science and math backgrounds are in particular demand for research and development work in electronics, missile development and other defense related activities. In general, graduates with majors in mechanical, electrical, and aeronautical engineering appear to be in greater demand than those with majors in civil, chemical and industrial engineering.

Although the employment situation in 1959 appears to be improved over last year, employers are continuing to be highly selective in their hiring practices. Men graduating near the top of their class will still be actively sought after, but those at the lower end may have to go beyond campus interviews to find engineering jobs.

Continued expansion of the profession is expected both in the next few years and over the long run. Factors which will contribute to a growing demand for engineering personnel are the continuing needs of the defense program, our growing population, rising living standards, the expansion of industry, the increasing complexity of industrial technology, and the continued extension of research and development activities. Rising engineering enrollments in colleges and universities will require more teachers of engineering. Substantial numbers of engineers are needed annually to replace those who retire, die, or transfer to other occupations. Losses to the profession from death and retirement alone are estimated to be about 10,000 each year.

Engineering starting salaries, which showed signs of leveling off in 1958, now appear to be rising again. Median starting salaries offered to new graduates with the bachelor's degree are expected to be about $500 a month in 1959. Monthly starting salaries for the small number of engineering graduates with advanced degrees, particularly the doctor's degree, will, as in previous years, be considerably higher than those given bachelor's degree graduates.

Physical Sciences

Employment opportunities for well-trained chemistry graduates at all levels are expected to be good in 1959. However, the selectivity which characterized employer hiring practices last year will be prevalent again this year. Employers are particularly interested in graduates with Ph.D. and master's degrees, and in bachelors ranking high in their graduating class. Graduates with bachelor's degrees standing low in their class may have to hunt to obtain jobs in their field.

The long-run outlook is for continued growth of employment in chemistry. The industries which employ most chemists will continue to expand; in particular, the chemical industry, which employs about one-fourth of all chemists, is expected to grow at a much faster rate than industry in general. In this industry and many others, continued expansion of research and development activities (in which almost half of all chemists are employed) is expected to accompany and contribute to industry growth. The great rise in enrollments anticipated in colleges and universities will result in many openings in teaching. Besides those needed for expansion in employment, about 1,200 chemists are required each year to replace those who retire or die, and this number will rise slowly in the future.

Median starting salaries for new chemistry graduates with a bachelor's degree and no experience were about $430 per month in 1958, according to a survey conducted by the American Chemical Society. For graduates with a master's degree but no experience, the median starting salary was about $511, and for those with the Ph.D., $675. Women graduates with bachelor's degrees had a lower median salary than men--$374 compared with $440. Indications are that starting salaries for chemists will be somewhat higher in 1959 than in 1958 when the survey was conducted.

Job prospects for well qualified physics graduates are excellent and are likely to remain very good in the foreseeable future. Persons with advanced training, qualified to do basic research or advanced applied research and development, are and will probably continue to be in particular demand. Research organizations in government, universities and industry are having considerable difficulty in satisfying their requirements for physicists, and these requirements will increase further if expenditures for research and development continue to grow as expected. Physicists qualified to teach in colleges and universities are also in great demand and this need will become greater as college enrollments increase during the next decade.

Mathematics

The employment outlook for graduates with a major in mathematics is very good at all levels of training and excellent for graduates with the Ph.D. degree. Persons qualified to teach mathematics at the college level and mathematics graduates qualified to work on physics and engineering problems are in special demand. Among the factors which should increase the demand for mathematicians are the expected further growth of scientific research and development and the growing enrollments in colleges and universities, which will result in a substantial increase in demand for mathematics teachers. The demand for the services of mathematicians in scientific research and development is closely associated with the development of high-speed electronic computing machines which make possible the rapid solution of a steadily widening variety of complex physics and engineering problems. New graduates who have broad training in mathematics and statistics and a knowledge of engineering or the physical sciences are in demand for many types of work, including operations research, quality control and preparing problems for solution by electronic computing equipment. Graduates with degrees in mathematics are also in strong demand for actuarial positions in insurance companies.

Earth Sciences

Newly trained geology graduates can expect to meet considerable competition for professional jobs. Of the bachelor's degree graduates, those from schools with strong curricula who rank high in their class will have the best opportunities for employment, principally in exploration work for the oil industry in the U.S. or overseas. Those who have only minimal training will probably find it necessary to begin in semi-professional jobs or to obtain work outside the field of geology. Graduates with advanced training, particularly the Ph.D. degree, are in much greater demand. Employment opportunities in the Federal Government service, for example, are chiefly for graduates with advanced degrees.

Over the long run the outlook is for growth of the geological profession. As the world's petroleum, mineral, and water resources diminish, additional geologists with advanced training will be needed to devise new techniques for locating new sources of supply, and to do more extensive research and analysis of geological data. Furthermore, the number of students studying geology is expected to increase in the years ahead, and there will be many openings for teachers of the science.

Employment opportunities for the few students obtaining degrees in geophysics continue to be good. Demand is greatest for those with graduate training. The oil industry will offer geophysical scientists employment opportunities both in the United States and abroad. Mining companies are expected to provide employment for a few geophysicists to locate new deposits of industrial minerals. In Federal agencies, mounting civil and military demands will necessitate larger staffs of geophysicists to do work in connection with investigation of water resources and flood control, research in radioactivity and cosmic and solar radiation, and exploration of the outer atmosphere by rockets, guided missiles and satellites.

Meteorologists are needed by the U.S. Weather Bureau to fill vacancies in weather forecasting positions and to staff expanding programs of hurricane research, air pollution research, storm warning, and flood forecasting. Private industry is also expected to provide some opportunities for workers in this field. Meteorologists qualified for research positions are particularly in demand, both by Government agencies and private employers. In addition, America's entry into the "Space Age" is expected to broaden considerably the horizons of meteorology, thereby creating new applications of the science.

Biological Sciences

The general employment situation is good for well-trained graduates with degrees in the biological sciences. Graduates with Ph.D. degrees are in great demand, particularly those with doctorates in microbiology, physiology, and pharmacology. Well-trained graduates with less than the Ph.D. degree should also be able to find employment related to their specialties, often as junior professional assistants in research laboratories.

Over the long run employment in the biological sciences is expected to increase substantially. Growth in expenditures for basic and applied biological research in the fields of medicine and agriculture is likely to be a major factor in the increased demand for biological scientists. Industry is increasingly recognizing the potentialities of biological research and should provide many more openings for biologists in the future. Another factor which is expected to stimulate demand for biological scientists is the rising college enrollments expected in the 1960's which will increase the need for teachers of the biological sciences.

RESEARCH CHECKLIST

( ) Ceramic Materials: Air Materiel Command is interested in developing manufacturing methods on a pilot scale plant for production of high purity ferroelectric and piezoelectric ceramic raw materials in the titanate, zirconate and niobate group. Objective is reliability in electronic components for operation at high temperatures in advanced aircraft and missiles. Air Force has found that such materials now vary in purity, density, particle size and hardness, even in the same batch.

( ) Combustion Research: Bureau of Mines Studies show that hot gases from an extinguished explosion can ignite cold combustible mixtures. Tests conducted on the propagation of explosions through short cylindrical channels are said to have practical significance in design of electrical mine equipment.

(Report Available. Free. Write U.S. Bureau of Mines, Publication Distribution Section 4800 Forbes Street, Pittsburgh, 13, Pa. For Report of Investigation No. 5457)

( ) Gases In Metals: National Bureau of Standards has available a new set of eight bars of ferrous materials, whose oxygen and nitrogen content have been precisely determined. A similar program, covering a variety of metallurgical products, is now underway. Samples are used to measure gas content of metals and in calibration of commercial apparatus.

(Details Available. Free. Write National Bureau of Standards, Office of Technical Information, Washington 25, D.C. for Summary Technical Report No. 2364)

( ) Satellite Applications: A patent application has been filed by Space Electronics, Inc., Glendale, Calif. for SARUS, a search and rescue system using satellites. Proposal utilizes doppler techniques to search and find missile nose cones, space capsules or suitably equipped aircraft and ships.

( ) Alloy Research: Navy has developed a new family of austenitic alloys containing a minimum amount of nickel. The steels are manganese-stabilized with age hardening characteristics promoted by vanadium and molybdenum. Project is part of a Navy effort to produce alloys for use aboard minesweepers. Widespread use of conventional non-magnetic casting alloys is said to be precluded by cost, limited mechanical properties, or in some cases, physical properties.

(R&D by Metallurgy Division, Metal Processing Branch, U.S. Naval Research Laboratory, Washington 25, D.C.)

( ) Electronic Distance Measuring: Atmospheric disturbances which tend to limit the accuracy of new electronic distance measuring (EDM) equipment are being studied at the National Bureau of Standards Laboratory, Boulder, Colo. Research is directed toward instrumentation for rapid, accurate field measuring of propagation velocity and toward the problem of extrapolating and interpolating spot measurements along a path to obtain the best estimate of the correction for the whole path.

(Research by Lower Atmosphere Physics Section, Radio Propagation Engineering Division, Boulder Laboratories)

( ) Optical Communication Research: Navy is investigating the potential applications of pulsed gaseous discharge light sources in operational communication systems and in laboratory instrumentations. Such a source must be well-defined in position and configuration and must be geometrically stable from flash to flash. A device has been constructed to test the principle of flash-tube discharge guidance by means of high-energy particle trails.

(R&D by Optics Division, Radiometry II Branch, U.S. Naval Research Laboratory, Washington 25, D.C.)

( ) Electron Tube Glass: Army Signal Corps is investigating new types of electron tube glass suitable for use in nuclear radiation fields. Initial phase is limited to those glasses which suffer physical destruction or release gas under nuclear radiation bombardment. It is believed that the boron -10 isotope in so-called hard glasses is the factor involved.

(Research by Chatham Electronics Division, Tung-Sol Electric Inc., Livingston, N.J.)

( ) Corrosion Indicators: Air Force is investigating possible production techniques for thin metal indicators which will provide reliable and inexpensive indication of corrosion in packaged and stored components, particularly in missiles. Tape, visual and electrical alarm indicators are under study.

(R&D by Crest Instrument Co., Santa Fe Springs, Calif. for Wright Air Development Center, Dayton, Ohio)

( ) Oil Well Research: Government research indicates that the water softener sodium tripolyphosphate may play an important role in the secondary recovery of petroleum from old oil wells. Since some oil bearing rock has an affinity for oil and others for water the addition of the chemical increases the affinity for water and eases the task of displacing the oil.

(R&D by Surface Chemistry Department, Petroleum Experiment Station, U.S. Bureau of Mines, Bartlesville, Oklahoma)

( ) Capacitor Research: Studies sponsored by the Air Force indicate that two dielectric materials -- magnesium oxide and aluminum oxide -- are among those with insulation resistances high enough for use in capacitors for operation under nuclear radiation at temperatures of 500° C. Tests also showed that boron nitride would be useful at such temperatures in the absence of radiation. Studies also included methods for fabrication of the oxides.

(Report Available. 81 pages. $2.25. Write OTS, U.S. Department of Commerce, Washington 25, D.C. for PB 151 256)

( ) Oxygen Research: Studies for Wright Air Development Center indicate that the reversal of basic processes of human metabolism by chemical reduction affords a prime method of providing an adequate supply of breathing oxygen for extended spaceflight. A reducing agent would be used to convert carbon dioxide into solid carbon. In a follow-up step, the oxygen would be recovered as a gas.

(R&D by Dr. John F. Foster, Battelle Memorial Institute, Columbus, Ohio)

PUBLICATION CHECKLIST

( ) Satellite Communications, a non-technical summary of programs and proposals for civilian and military use of satellites in communications. 9 pages. Free. (Write Committee on Science and Astronautics, New House Office Building, Washington 25, D.C.)

( ) Atomic Indemnity Problems, a report on safety and indemnity considerations in the U.S. civilian and military reactor programs. Includes proposed legislation on the same subjects. 60 pages. Free. (Write Joint Committee on Atomic Energy, F-88, The Capitol, Washington 25, D.C. for AEC Report on Indemnity Act)

( ) Alloys and Specifications, a new reprint of a sold-out 1958 publication providing a cross-index of chemically equivalent specifications and an identification code for ferrous and nonferrous alloys. Volume facilitates compilation of raw material requirements and provides a reference for comparison of various material compositions. 366 pages. $1.75 (Write Government Printing Office, Washington 25, D.C. for Pub. No. D 7.6/2:1B)

( ) Military Procurement, transcript of closed-door hearings now released on procurement plans of the Army, Navy and Air Force in such fields as aircraft, missiles, ship construction, electronics and vehicles. A valuable guide for defense contractors. 864 pages. Single copies free as available. (Write Committee on Appropriations, U.S. House of Representatives, The Capitol, Washington 25, D.C. for Defense Appropriations Hearings, Part 5 - Procurement)

( ) Aerospace Research, the final annual report of the National Advisory Committee for Aeronautics, including a history of the NACA and a sketchy outline of recent research projects. 115 pages. Free. (Write Information Office, National Aeronautics and Space Administration, 1520 H Street, N.W., Washington 25, D.C. for NACA 1958 Annual Report)

( ) Missile Programs, a controversial and critical report on management of missile projects by both government and industry. Covers programs of Ramo-Wooldridge Corp., Johns Hopkins University, Bendix Aviation, North American Aviation and other organizations. 47 pages. Free. (Write Rep. James C. Davis, Chairman, Subcommittee on Manpower, U.S. House of Representatives, Washington 25, D.C. for Preliminary Report, Aspects of the Missile Program)

( ) High Purity Metals, a catalog of high purity metals available from American Producers including purities, analyses, price and source of supply. $1.50. (Write OTS, U.S. Department of Commerce, Washington 25, D.C. for Report No. ISC - 1029)

( ) Marine Radioactivity, a report on basic research in atomic waste disposal, effects of nuclear testing and related factors in the oceans and seas. 31 pages. Free. (Write Information Office, National Academy of Sciences, 2101 Constitution Ave., Washington 25, D.C. for Oceanography 1960 to 1970, Chapter 5)

( ) Spark Ignition, a new bulletin which discusses recent developments in research on the ignition of combustible gas mixtures by electric sparks. 9 pages. Free. (Write Publications Distribution Section, U.S. Bureau of Mines, 4800 Forbes St., Pittsburgh 13, Pa. for Report of Investigations No 5461)